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(71) Applicant(s)

Robert Bosch GmbH  
(Incorporated in the Federal Republic of Germany)  
Wernerstrasse 1, Stuttgart-Feuerbach,  
D-70442 Stuttgart, Federal Republic of Germany

(72) Inventor(s)

Siegfried Keusch  
Steffen Wuensch  
Doris Reich  
Werner Neubert

(74) Agent and/or Address for Service

A A Thornton & Co  
235 High Holborn, LONDON, WC1V 7LE,  
United Kingdom

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(56) Documents Cited

EP 0558253 A US 5199501 A

(58) Field of Search

UK CL (Edition R ) B3C, B3D, B5L, F4X  
INT CL<sup>7</sup> B23Q, B24B

(54) Abstract Title

Hand held machine tool dust extraction system

(57) A hand-held machine tool (10) with a dust extraction system (19) disposed in its housing (12) and with a blow-out connecting piece (20) which has a self-supporting dust box (21) detachably fastened and engaged over the blow-out connecting piece (20) with the aid of a blow-in connecting piece (22). The dust box (21), which - except for two sides - is air-tight, can be detachably fastened to the housing (12) with the aid of fastening means and also of a projection (24), particularly a hook, disposed on its upper side (36). Air outlet apertures (40) are disposed on the upper side (36) of the dust box which carries, on its inner side, a dust-tight filter element, particularly a folded filter.

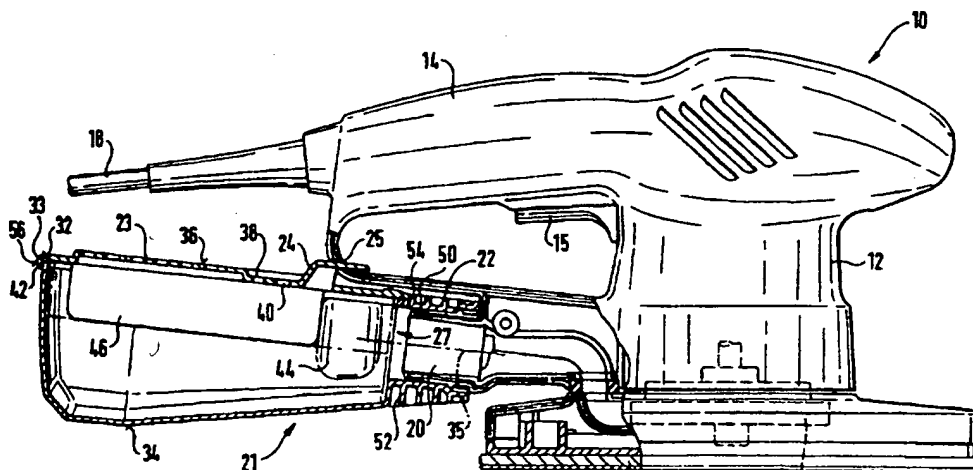


FIG. 1

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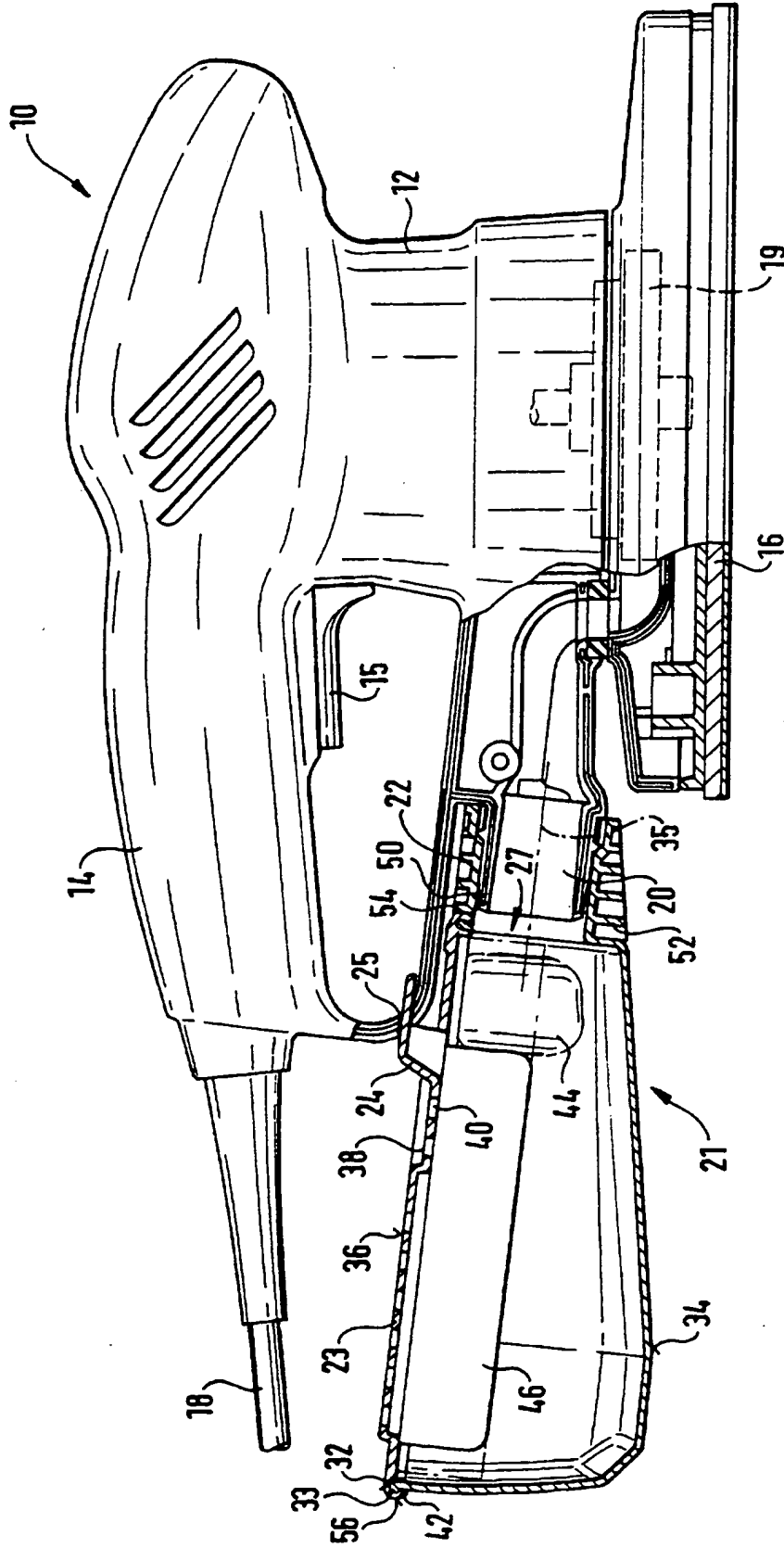
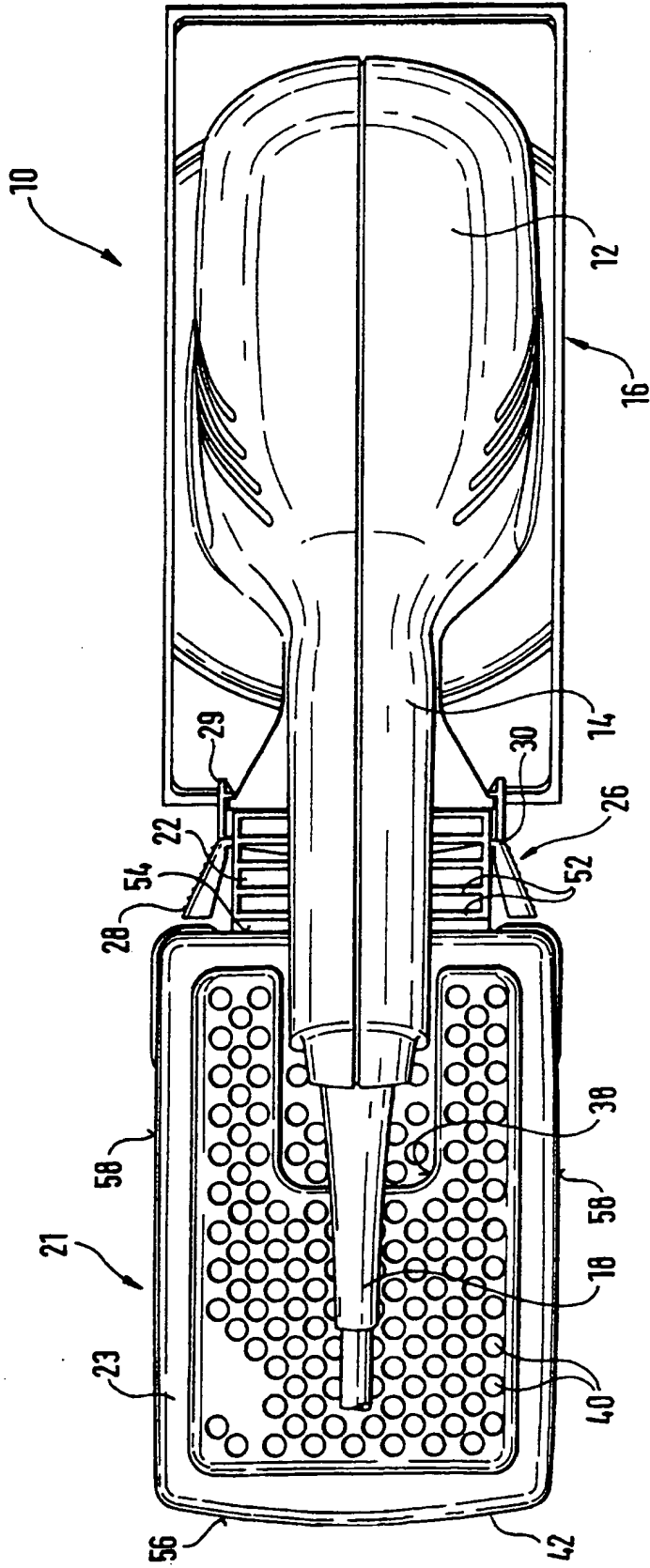


FIG. 1

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**FIG. 2**

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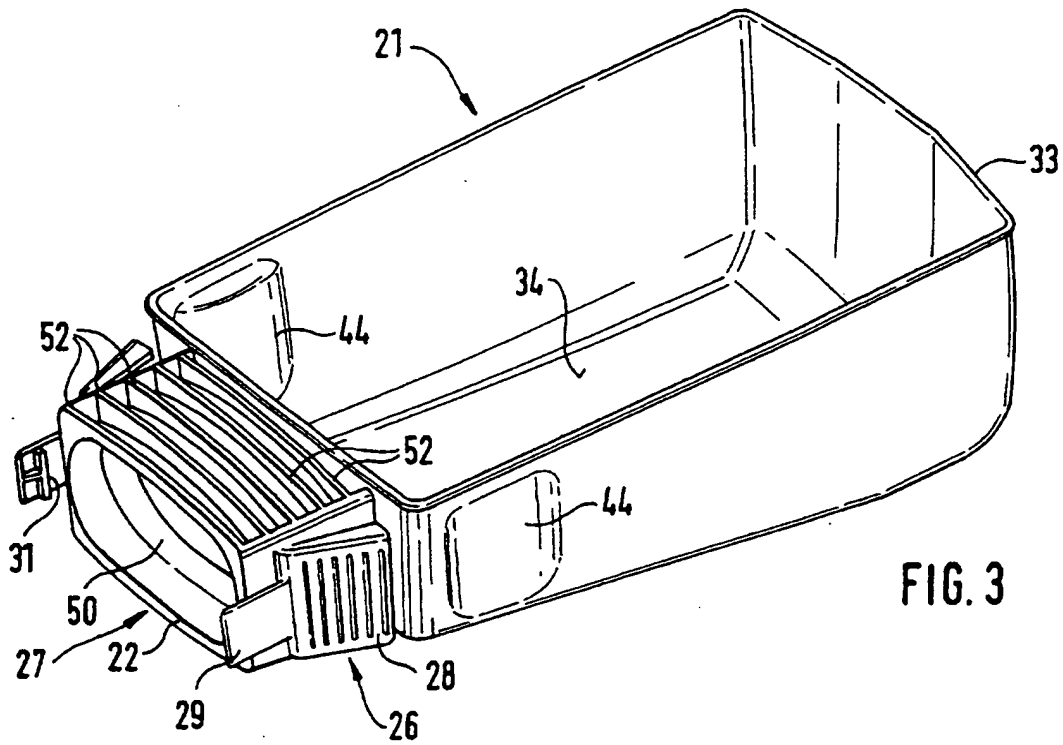


FIG. 3

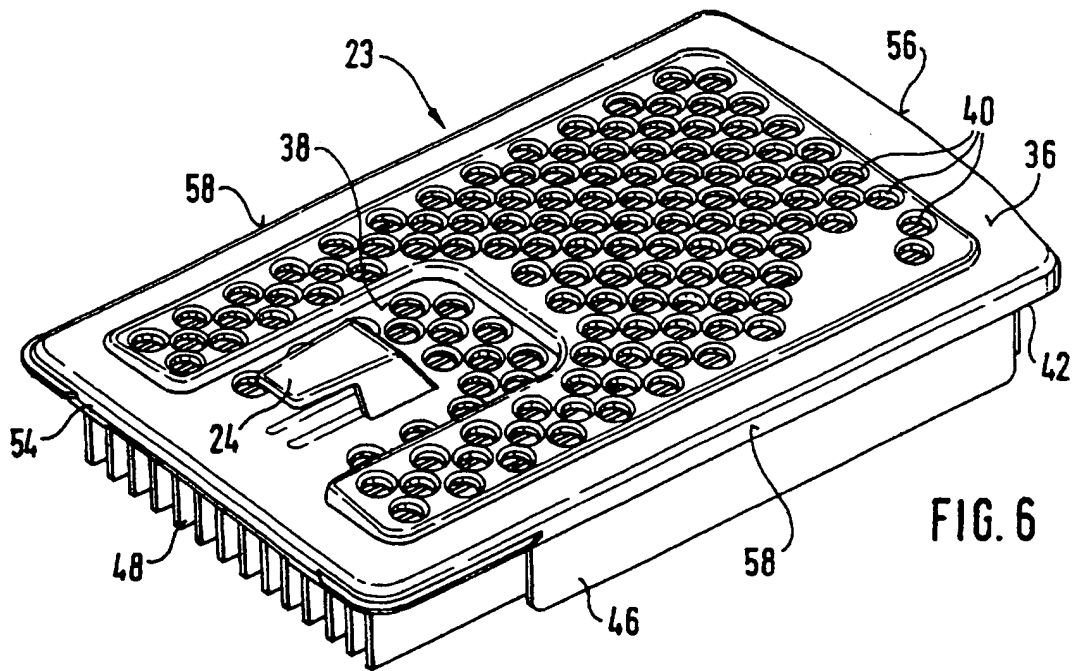
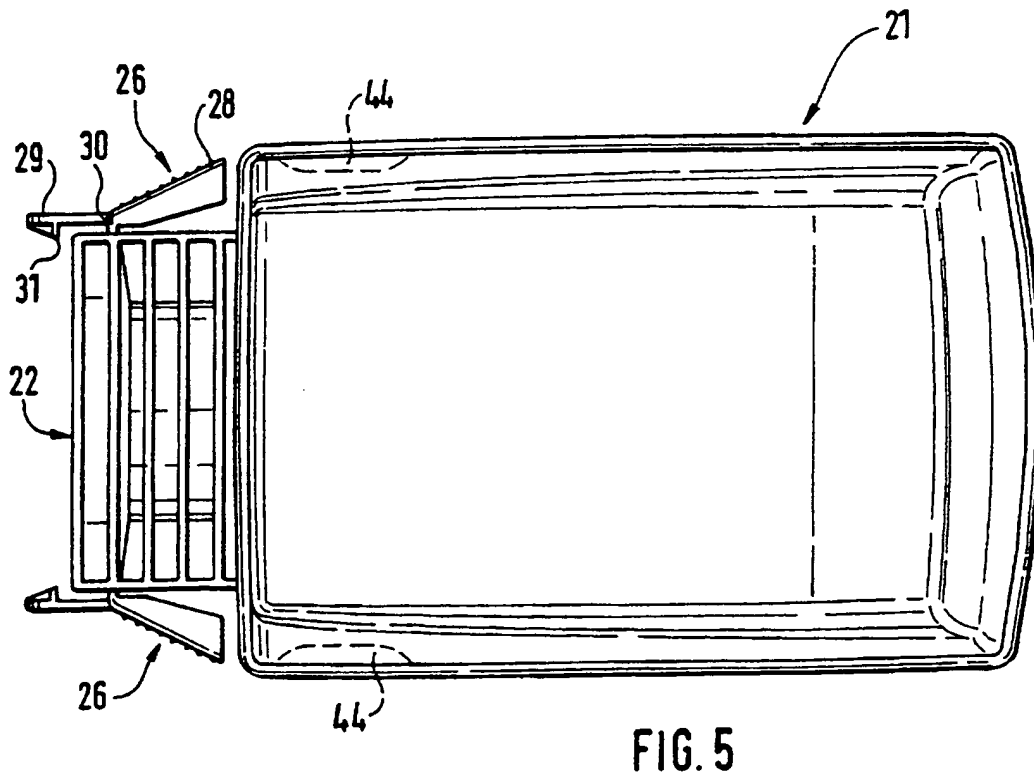
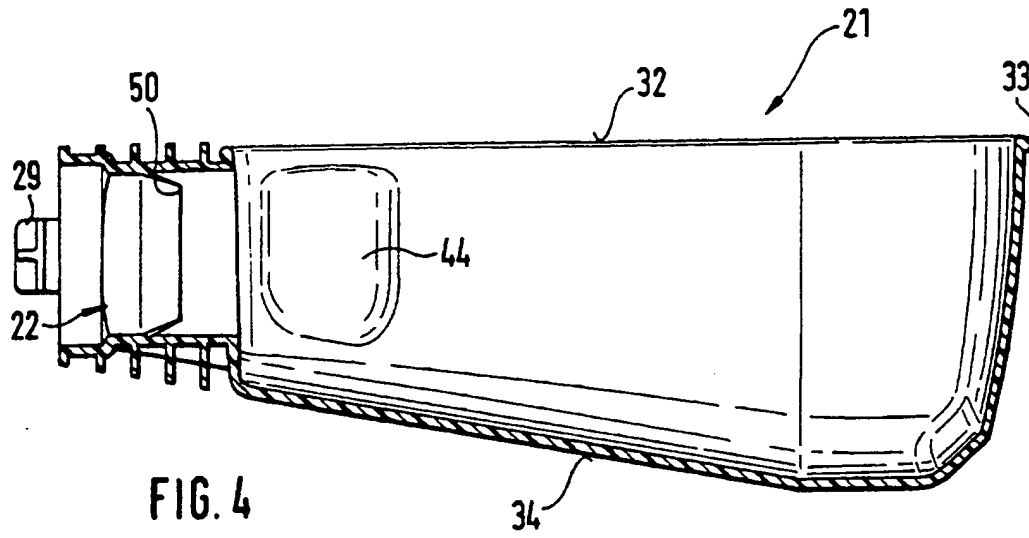
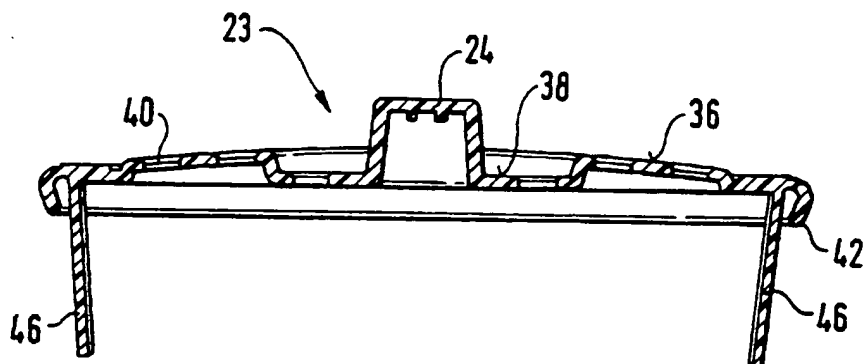
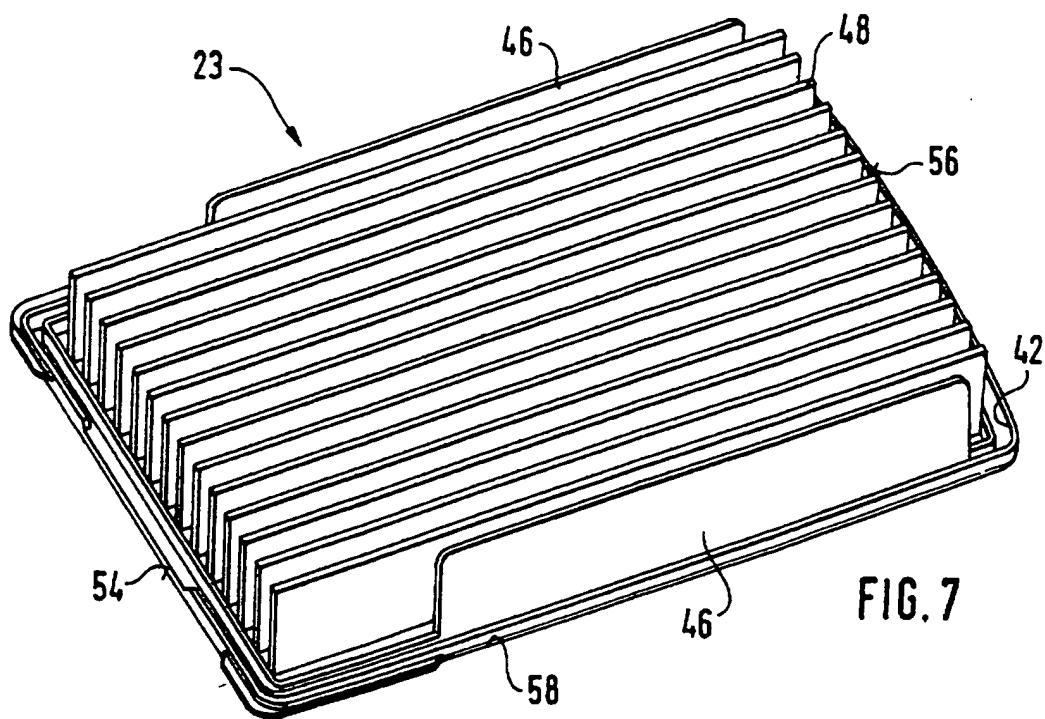


FIG. 6





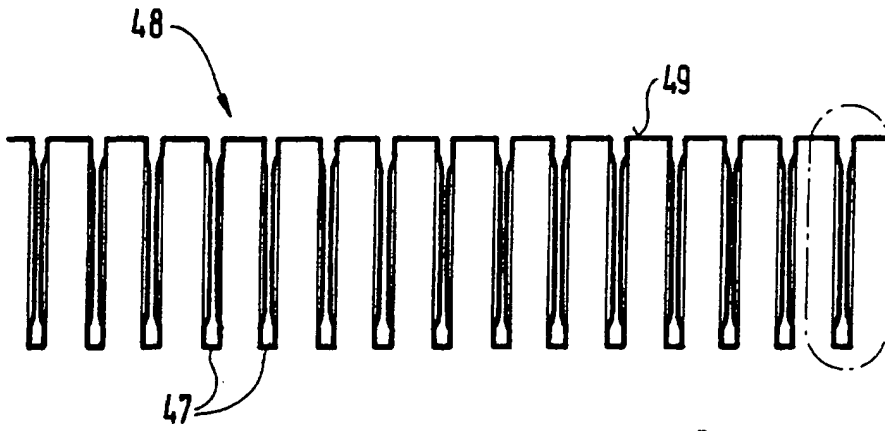


FIG. 9

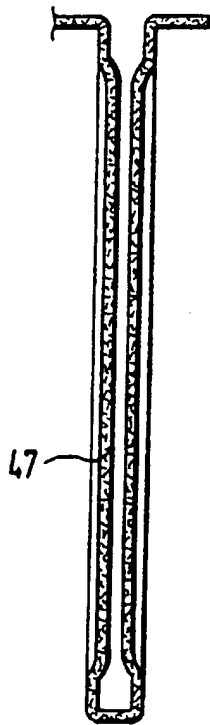


FIG. 10

Hand-held machine tool with dust extraction system

## Prior art

The starting point of the invention is a hand-held machine tool of the kind in claim 1.

From US 4,192,390, a hammer drill is known which has its own dust extraction system by means of which drilling dust which is produced can be sucked - on the vacuum cleaner principle using suction air - into a dust box which is mounted on the hammer drill in a relatively complicated manner, the said suction air passing through a plate-shaped dust filter at which the drilling dust is separated off and collects in the dust box. The dust box is intended to remain on the hammer drill and has a base which can be swung open for emptying the drilling dust.

US 5,467,835 makes known another hammer drill which has a dust-extracting arrangement by means of which drilling dust which is produced can be sucked - likewise on the vacuum cleaner principle using suction air - into a separate dust box which is detachably inserted in a housing. Disposed in front of the extraction aperture of the said dust box, towards the suction fan, is a folded filter at which the dust is separated off during the passing-through of the suction air, and collects in the dust box, so that clean air is transported to the suction fan. The dust box can be removed from the housing for the purpose of emptying the drilling dust, and the latter can be shaken out through the inlet aperture.

The dust boxes of the two known hammer drills can be emptied only in a relatively laborious manner, changing of the plate filter or folded filter being complicated. Furthermore, these dust boxes are unsuitable for self-supporting fastening to hand-



held machine tools with an integrated dust extraction system for blowing in the dust.

Hand-held machine tools are also known which are provided with plastic cartridges which serve as a dust box and which are either provided - after the fashion of a grass-collecting receptacle for lawn mowers - with a multiplicity of air-conducting apertures and lined with filter material, or else consist of porous, air-permeable plastic of low dimensional stability which is intended to let the air blowing in the dust out of the receptacle in the cleaned condition and to retain the dust in the said receptacle. Both plastic cartridges are inclined to clog up and can be emptied and cleaned only with considerable effort.

#### Advantages of the invention

In contrast to this, the hand-held machine tool with dust extraction system according to the invention which has the features in claim 1 has the advantage that a particularly light and compact dust box is provided which is able to hold a large volume of blown-in dust without losing its inherent stability, it being possible for extraction of the grinding dust from the tool to take place, practically up to maximum capacity, with constantly high efficiency and high filter service life and with improved fine dust filtration.

Through the fact that the dust box is secured to the hand-held machine tool with the aid of a projection on its upper cover, as well as to the dust blow-out connecting piece on the said machine tool, the forces of deformation when the dust-filling capacity is full are reduced in such a way that the wall cross-sections of the dust box can be small and, as a result of this, the said dust box is particularly light but stable.

Through the fact that, as a case which is open at the top, the dust box is provided with a detachable cover which closes the aperture from above, only a slight loss of pressure occurs during the extraction of dust, it being possible, by opening the cover, to discharge the dust in a particularly convenient manner without turbulence and without polluting the environment.

Through the fact that only the cover carries a filter, in particular a folded filter, and is provided, as an individual part of the dust box, with apertures for the passage of air, the filtering surface may be of particularly large dimensions. As a result of this, the air transporting the dust is dammed up only to a minimal extent and the efficiency of the dust extraction system is high. Furthermore, the dust is able, from a certain layer thickness onwards, to detach itself from the folded filter automatically and, obeying the force of gravity, to drop into the dust box.

Through the fact that that face of the dust box which carries the cover is inclined in such a way, in relation to the direction of flow of the blow-out air, that the dust box tapers in a wedge-shaped manner towards the machine, flow conditions are set up for the blow-out air which avoid damming-up and as a result of which the transporting-away of dust is optimised.

Through the fact that the cover is secured in an elastic and leakproof manner to the dust box, the latter is particularly simple to open and can be easily closed again.

The lateral indentations in the dust box which are provided for opening the cover make it easier for the operator to grip underneath the dust box with the fingers, and facilitate one-hand operation without tools when removing, emptying and re-fastening the dust box.

Through the fact that sealing lips which engage in a sealing manner round the dust blow-out connecting piece on the hand-held machine tool are disposed in the inlet connecting piece on the dust box, the latter is reliably dust-tight when the hand-held machine tool is being operated.

Through the fact that the folded filter is disposed only in the cover of the dust box, it can be replaced particularly easily, either by gluing in a new one or by exchanging the entire cover, together with the filter.

Through the fact that the dust box can be fastened to the hand-held machine tool with the aid of rocker-like locking levers, its removal and emptying and re-fastening is possible in a particularly convenient and time-saving manner.

Through the fact that the inlet connecting piece of the dust box can be closed by means of a valve, the unintended egress of dust when the dust box is detached from the hand-held machine tool can be effectively prevented.

#### Drawings

The invention is explained in greater detail below with the aid of an exemplified embodiment with appertaining drawings, in which:

figure 1 shows a longitudinal section through a hand-held machine tool with a dust box according to the invention,

figure 2 shows a plan view of the hand-held machine tool according to figure 1,

figure 3 shows a three-dimensional view of the dust box without the cover, viewed obliquely from the front,

figure 4 shows a longitudinal section through the dust box without the cover,

figure 5 shows a view of the dust box from below,  
figure 6 shows a three-dimensional plan view of the dust box cover,  
figure 7 shows a three-dimensional underneath view of the dust box lid,  
figure 8 shows a cross-section through the dust box cover,  
figure 9 shows a cross-section through the folded filter of the dust box cover, and  
figure 10 shows an enlarged cross-section of an individual lamella belonging to the folded filter.

#### Description of the exemplified embodiment

The longitudinal section in figure 1 shows a hand-held machine tool 10 which is designed as an oscillating grinder and has a housing 12 which has a handle 14 with a switch 15 and to the bottom of which a tool 16 designed as a grinding tray is movably attached. The hand-held machine tool 10 carries an electrical connecting lead 18 at the rear end of the handle 14, and a fan wheel 19 in the interior of the housing 12. The said fan wheel generates a negative pressure above the grinding tray 16 when the hand-held machine tool is being operated. As a result of this, grinding dust is extracted at and under the grinding tray 16 and blown through a blow-out connecting piece 20 on the housing 12.

The blow-out connecting piece 20 carries a blow-in connecting piece 22 which is inverted over it and belongs to a dimensionally stable dust box 21 which is disposed in a self-supporting manner. The said dust box 21 is air-tight - apart from the blow-in aperture 27 of the blow-in connecting piece 22 and the upper side of the said box. The upper side of the dust box 21 is formed by a cover 23, from the upper side 36 of which a hook 24 passes upwards for engagement in a holding aperture 25 in the rear region of the handle 14. The dust box 21 is additionally secured by means of the hook 24 to the housing 12 of the hand-held

machine tool 10, so that the structure of the housing of the dust box 21 can be built with particularly thin wall cross-sections and thereby in a particularly light manner. The cover 23 of the dust box 21 is secured to the upper edge 32 of the dust box 21, which upper edge forms a circumferential bead 33, so as to over-latch in a resiliently elastic manner with its snap-in rim 42 in a particularly leak-proof, force-locking and form-locking manner.

The underside 34 of the dust box 21 extends at an inclination in relation to the longitudinal axis of the blow-in connecting piece 22, so that the dust box 21 extends, in longitudinal section, in a wedge-shaped manner in relation to the axis 35 and tapers towards the hand-held machine tool 10. The upper side 36 of the cover 23 carries circular air outlet holes 40 in front of which a filter element 48 made of special paper and designed as a folded filter is interposed. Furthermore, the upper side 36 of the cover 23 is provided, in the region of the hook 24, with an indentation 38 which is directed into the dust box 21, has a contour extending in a U-shaped manner, stiffens the structure of the cover 23 and offers free space for the passage of larger housing contours, which protrude further, of other hand-held machine tools.

In its front region near the blow-in connecting piece 22, the dust box 21 carries, on opposite sides, two lateral indentations 44 which make it easier for the operator's fingers to grip underneath the cover 23 and thereby facilitate convenient opening of the latter.

The said cover 23 carries, in one piece, two lateral lamellae 46 which extend parallel to the lateral edges 58 of the dust box 21 and which protrude, in a keel-like manner, into the interior of the dust box 21 and form a lateral boundary and mechanical protection for the filter element 48, in the event of the cover being

removed from the dust box 21 and put down, or of the dust being knocked off from the filter element 48.

In the interior, the blow-in connecting piece 22 on the dust box 21 has a circumferential sealing lip 50 which encloses the blow-out connecting piece 20 on the hand-held machine tool in an air-tight manner. Furthermore, the blow-in connecting piece 22 on the dust box 21 carries, at the top and bottom, ribs 52 which improve the rigidity of the dust box 21 when the wall cross-section is small.

Figure 2 shows the previously mentioned details of the hand-held machine tool 10 with the dust box 21, it being possible to see the following particularly clearly, to a greater extent than in figure 1: the indentation 38 in the cover 23, the holes 40 for the passage, towards the outside, of the blow-out air which has been cleaned of dust, and a rocker 26 for the over-latching fastening of the dust box 21 to the hand-held machine tool 10. The rocker 26 on the dust box 21 is designed as a two-armed lever of which one arm is designed as a key-type arm 28, and its other arm as a latching arm 29. The rocker 26 is fastened to the blow-in connecting piece 22 on the dust box in a pivotable manner by means of a film hinge 30. The latching arm 29 is secured, in an elastically pre-tensioned manner, to a lateral projection, of which no further details are indicated, on the housing 12 of the hand-held machine tool 10 in the region of its blow-out connecting piece 20.

It also becomes clear that the basal surface of the hand-held machine tool 10 is formed by the rectangular grinding tray 16, and that the rear edge 56 of the dust box 21 or of the cover 23 is arched outwards.

The detail shown in figure 3 of the dust box 21 without the cover 23 shows, once again, its details which have been mentioned in connection with figures 1 and 2.

Also visible is the bead 23 which runs round with the upper edge 32 in a closed manner and forms, jointly with the snap-in rim 42 (figures 1, 7), a connection, which closes in a leakproof manner and is convenient to open, between the cover 23 and the dust box 21. Also to be seen are the indentations 44 which make it easier to grip laterally underneath the cover 23 and open it with the fingers. Also clearly to be seen are the blow-in connecting piece 22 with the circumferential sealing lip 50, the rockers 26 disposed on opposite sides, and also their key-type arm 28 and latching arm 29, of which there is one in each case, with an internal latching edge 31 for engagement in a recess in the blow-out connecting piece 20 for securing the dust box 21 to the hand-held machine tool 10 in a form-locking manner.

Figure 4 shows the longitudinal section through the dust box 21, with the circumferential bead 33 on the upper edge 32 of the dust box 21, it being possible to see particularly clearly the location of the sealing lip 50 on the inside of the blow-in connecting piece 22 on the dust box 21.

Figure 5 shows the plan view of the open dust box 21 with the upper edge 32, the indentations 44, the dust blow-in connecting piece 22 and the rocker 26. The key-type arm 28 of the rocker 26, with knobs of which no further details are indicated, the latching arm 29 and the latching edge 31, which is disposed on the inner side of the latter, for engaging in a recess in the hand-held machine tool 10, of which recess no further details are indicated, are particularly clear.

Figure 6 shows the three-dimensional plan view of the cover 23 of the dust box 21 with the round holes 40 for the passage of air, which holes pierce the cover 23, the arched rear edge 56, the straight lateral edges 58, and also the straight front edge 54. Also clearly visible is the hook 24 which passes, in an upwardly and

forwardly cranked manner, out of the indentation 38 imprinted in the cover 23. Also to be seen are the lateral lamella 46 which are in one piece with the cover 23, protrude downwards in a keel-like manner and serve as mechanical protection against damage for the folded filter 48 which is orientated downwards in a rib-like manner.

Figure 7 shows a three-dimensional view of the underside of the cover 23, it being possible to see the snap-in rim 42, the keel-like lateral lamellae 46 and the filter element 48, which is provided with rib-like lamellae 47 extending in the longitudinal direction of the dust box 21 and is designed as a folded filter. Also visible are the outwardly arched rear edge 56, the straight front edge 54 and the straight lateral edges 58.

From the cross-section of the cover 23 according to figure 8, it is possible to clearly see the disposition of the keel-like lateral lamellae 46, and also the circumferential snap-in rim 42, the indentation 38 with the hook 24 which passes out upwards, and the upper side 36 with the apertures 40 for the passage of air, which upper side extends upwards or outwards in a slightly arched manner.

Figure 9 shows the detail of the filter element 48, which is constructed as a lamellae-type filter, for non-detachable insertion in the cover 23. The filter lamellae 47 of the said filter extend in a rib-like manner parallel to the lateral lamellae 46 on the cover 23, or in the longitudinal direction of the dust box 21. It also becomes clear from figure 9 that the filter lamellae 47 have been manufactured, in a manner which increases the surface, by the meander-like folding and stamping-out of a flat filter plate.

The enlargement of an individual filter lamella 47 shown in figure 10 shows the



meander-shaped design and also lateral stamped-out portions of the said lamellae. The result of this design is that, when a certain, critical quantity of dust accumulates, the said quantity detaches itself, obeying the force of gravity, from the filter lamella 47 so as to drop downwards into the dust box 21 and unblock the filter element 48 for the optimum passage of air.

## Claims

1. Hand-held machine tool (10) with a dust extraction system (19) disposed in its housing (12) and with a blow-out connecting piece (20) which is interposed after the said dust extraction system and to which a dust box (21) for collecting dust can be detachably fastened, particularly in a self-supporting manner, with the aid of its blow-in connecting piece (22), characterised in that the dust box (21), which - except for two sides - is air-tight, can be locked detachably on the housing (12) in an over-latching manner with the aid of fastening means (26), the said dust box (21) being detachably secured to the housing (12), preferably on the outermost region of the latter, with the aid of a projection (24), particularly a hook, disposed on the upper side (36) of the said box, and that the upper side (36) of the dust box (21) has air outlet apertures (40), a dust-tight filter element (48), particularly a folded filter, being disposed on the inner side thereof.
2. Hand-held machine tool according to claim 1, characterised in that the dust box (21) is a case with a detachable cover (23) which forms the upper side.
3. Hand-held machine tool according to claim 2, characterised in that the cover (23) is arched outwards and carries outlet apertures (40), particularly round ones, for the passage of air, an intermediate space being formed between the inner side of the said cover and the filter element (48).
4. Hand-held machine tool according to claim 1 or 2, characterised in that the dust box (21) carries, on mutually opposed sides, indentations (44) for gripping underneath the cover (23) and removing it.

5. Hand-held machine tool (10) according to one of the preceding claims, characterised in that the dust box (21) carries, in the region of its blow-in connecting piece (22), a circumferential sealing lip (50) for engaging in a leakproof manner round the blow-out connecting piece (20) on the hand-held machine tool (10).

6. Hand-held machine tool according to one of the preceding claims, characterised in that the dust box (21) carries laterally and externally, in the region of its blow-in connecting piece (22), locking means (26) for securing it to the housing (12) in an over-latching manner.

7. Hand-held machine tool according to claim 6, characterised in that, as the locking means, one rocker-like, two-armed lever (28, 29) in each case is disposed on two mutually opposed sides of the blow-in connecting piece (22), which lever is fastened, particularly in one piece, to the blow-in connecting piece (22) by means of a film hinge (30).

8. Hand-held machine tool according to claim 7, characterised in that the rocker-like lever has a key-type arm (28), particularly with a knurling-like surface structure, and a latching arm (29) with a latching edge (31) for form-locking engagement in the housing (12).

9. Hand-held machine tool according to one of the preceding claims, characterised in that the underside (34) of the dust box (21) extends in a rearwardly cranked manner in relation to the axis of the blow-out connecting piece (20) on the hand-held machine tool (10) and in relation to the upper side (36) or the cover (23), in such a way that the dust box (21) tapers in a wedge-like manner towards the housing (12).

10. Hand-held machine tool according to one of the preceding claims, characterised in that the dust box (21) carries, on its blow-in connecting piece (22), a valve which opens the said blow-in connecting piece (22) when the dust box (21) is slipped onto the blow-out connecting piece (20), and which closes the said blow-in connecting piece (22) as soon as the dust box (21) is detached from the blow-out connecting piece (20).

11. A hand-held machine tool substantially as herein described with reference to the accompanying drawings.



Application No: GB 9915456.9  
Claims searched: 1-11

i4

Examiner: Dave Butters  
Date of search: 2 March 2000

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.R): B3D, B3C, B5L, F4X

Int Cl (Ed.7): B23Q, B24B

Other:

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
A	EP 0558253 A (BLACK & DECKER)	
A	US 5199501 A (HILTI)(see column 3, lines 34-40)	

X Document indicating lack of novelty or inventive step  
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